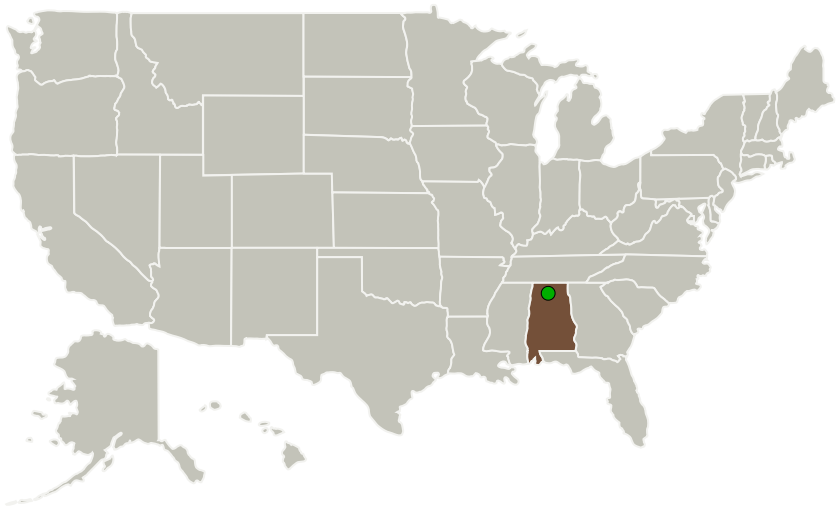
A Plateau-Burning, Low Temperature-Operable Solid Propellant for Mars Sample Return, Phase I

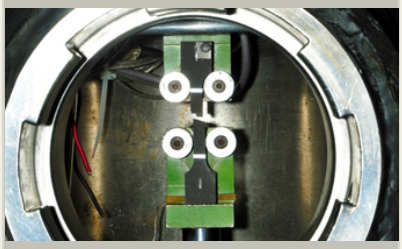
Completed Technology Project (2014 - 2014)

Project Introduction

The Mars ascent vehicle (MAV) is required to endure a long space transit time, high-g loading during planetary entry, and high launch loads, all at low temperatures of approximately -40 Deg C. Additionally, low-temperature motors like the MAV are often tested at room temperature, since testing at temperatures of -40 Deg C or lower is both difficult and expensive. Since testing at higher temperatures results in higher burn rates for typical propellants, and thus higher working pressures, ambient tests result in a motor case that is heavier than required for a low temperature mission, because ambient testing results in a higher maximum expected operating pressure. Our proposed technology alleviates that problem by using a plateau-burning composite propellant that will substantially lessen the burn rate sensitivity to temperature. As such, the MAV operating pressure in ambient conditions will more closely resemble those on the Mars surface, allowing for a lighter motor case resulting in reduced weight, smaller volume and greater propellant mass fractions. Additionally, our plateau burning formulation will include a low temperature binder with a high density fuel additive, in order to alleviate the loading stresses at low temperatures and further increase the motor density-Isp. This may allow us to eliminate the need for the MAV launch erection equipment currently baselined for the MSR mission.

Primary U.S. Work Locations and Key Partners





A Plateau-Burning, Low Temperature-Operable Solid Propellant for Mars Sample Return Project Image

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Organizations Performing Work	Role	Type	Location
ASRC Federal Astronautics, LLC	Lead Organization	Industry	Huntsville, Alabama
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations
Alabama

Project Transitions

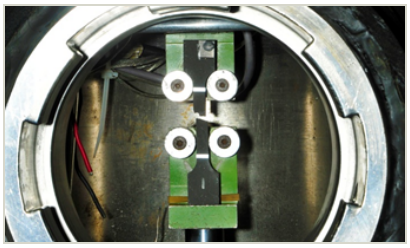
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138751)*

Images



Project Image
A Plateau-Burning, Low Temperature-Operable Solid Propellant for Mars Sample Return Project Image
(https://techport.nasa.gov/image/132840)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
ASRC Federal Astronautics, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

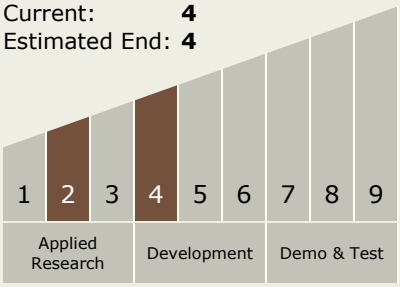
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Joseph Sims

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2014 - 2014)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.4 Solids

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System